**Practitioner's Docket No.** 944-003.030 ***PATENT***

Preliminary Classification:

Proposed Class:

Subclass:

*NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.'" M.P.E.P. § 601, 7th ed.*

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**Box Patent Application**
**Assistant Commissioner for Patents**
**Washington, D.C. 20231**

**NEW APPLICATION TRANSMITTAL**

Transmitted herewith for filing is the patent application of

Inventor(s): J. Marila et al.

***WARNING:*** *37 C.F.R.§ 1.41(a)(1) points out:*

*"(a) A patent is applied for in the name or names of the actual inventor or inventors.*

*"(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(l) is filed supplying or changing the name or names of the inventor or inventors."*

For (title): METHOD AND APPARATUS FOR MUSICAL MODIFICATION OF SPEECH SIGNAL

**CERTIFICATION UNDER 37 C.F.R. § 1.10***

*(Express Mail label number is **mandatory**)*
*(Express Mail certification is optional.)*

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date November 6, 2000, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL628639024US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Anita K. Schelmetic
*(type or print)name of person mailing paper*

Anita K. Schelmetic
**Signature of person mailing paper**

***WARNING:*** *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

***WARNING:*** *Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).*
*Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

Non-Fee 11-07-00



1. **Type of Application**

This new application is for a(n)

(check one applicable item below)

☒ Original (nonprovisional)

☐ Design

☐ Plant

***WARNING:*** *"**Do not** use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 37(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.*

***WARNING:*** ***Do not** use this transmittal for the filing of a provisional application.*

*NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.*

☐ Divisional
☐ Continuation
☐ Continuation-in-part (C-I-P)

2. **Benefit of Prior U.S. Application(s)** (35 U.S.C. §§ 119(e), 120, or 121)

*NOTE: A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. § 112. Each prior application must also be:*

*(i) An international application entitled to a filing date in accordance with PCT Article 11 and designated the United States of America; or*

*(ii) Complete as set forth in § 1.51(b); or*

*(iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or*

*(iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(l) within the time period set forth in § 1.53(f).*

*37 C.F.R. § 1.78(a)(1).*

*NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.*

***WARNING:*** *If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120,121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 199, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.*

***WARNING:*** *When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application* ***must*** *be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).*

☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**3. Papers Enclosed**

**A.** Required for filing date under 37 C.F.R. § 1.53(b) (Regular) or 37 C.F.R. § 1.153 (Design) Application
14 Pages of specification
5 Pages of claims
5 Sheets of drawings

***WARNING:*** ***DO NOT*** *submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. For comments on proposed then-new 37 C.F.R. § 1.84, see Notice of March 9, 1988 (1990 O.G. 57-62).*

*NOTE: "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm (5/8 inch) down from the top of the page . . ." 37 C.F.R. § 1.84(c)).*

*(complete the following, if applicable)*

☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. § 1.84(b).
☒ formal
☐ informal

**B.** Other Papers Enclosed

___ Pages of declaration and power of attorney
1 Pages of abstract
1 Other (Title Page)

**4. Additional papers enclosed**

☐ Amendment to claims

☐ Cancel in this application claims _____ before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)
☐ Add the claims shown on the attached amendment. (Claims added have been numbered consecutively following the highest numbered original claims.)

☐ Preliminary Amendment

☐ Information Disclosure Statement (37 C.F.R. § 1.98)

☐ Form PTO-1449 (PTO/SB/08A and 08B)

☐ Citations

- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

**5. Declaration or oath (including power of attorney)**

*NOTE: A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).*

*NOTE: A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(a)(1)-(4).*

*NOTE: "The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.62, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(l) is filed supplying or changing the name or names of the inventor or inventors." 37 C.F.R. § 1.41(a)(1).*

☐ Enclosed

Executed by

(check **all** applicable boxes)

- ☐ inventor(s).
- ☐ legal representative of inventor(s). 37 C.F.R. §§ 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.

  ☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F. R. § 1.47 is also attached. *See* item 13 below for fee.

☒ Not Enclosed

*NOTE: Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.*

☐ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of *all* the above named inventor(s).

*(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).*

☐ Showing that the filing is authorized.
*(not required unless called into question. 37 C.F.R. § 1.41(d))*

**6. Inventorship Statement**

***WARNING:*** *If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.*

The inventorship for all the claims in this application are:

☒ The same.

**or**

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,
☐ is submitted.
☐ will be submitted

**7. Language**

*NOTE: An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of $130.00 required by 37 C.F.R. § 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 C.F.R. § 1.52(d).*

☒ English
☐ Non English
☐ The attached translation includes a statement that the translation is accurate.

37 C.F.R. § 1.52(d).

**8. Assignment**

☒ An assignment of the invention to Nokia Corporation

☐ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.
☒ will follow.

*NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).*

***WARNING:*** *A newly executed "CERTIFICATE UNDER 37 C.F.R. § 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 193, 1150 O.G. 62-64.*

**9. Certified Copy**

Certified copy(ies) of application(s)

| Country | Appln. No. | Filed |
|---|---|---|
| Country | Appln. No. | Filed |
| Country | Appln. No. | Filed |

from which priority is claimed

☐ is (are) attached.
☐ will follow.

*NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(a) and 1.63.*

*NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.*

**10. Fee Calculation** (37 C.F.R. § 1.16)

**A.** ☐ Regular application

CLAIMS AS FILED

| Number filed | | Number Extra | | Rate | Basic Fee 37 C.F.R. § 1.16(a) $710.00 |
|---|---|---|---|---|---|
| Total Claims (37 C.F.R. § 1.16(c)) | -20 = | 0 | x | $18.00 = | |
| Independent Claims (37 C.F.R. § 1.16(b)) | - 3 = | 0 | x | $80.00 = | |
| Multiple dependent claim(s), if any (37 C.F.R. § 1.16(d)) | | | + | $270.00 | |

☐ Amendment canceling extra claims is enclosed.
☐ Amendment deleting multiple-dependencies is enclosed.
☐ Fee for extra claims is not being paid at this time.

*NOTE: If the fees for extra claims are not paid on filing, they must be paid or the claims canceled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(d).*

Filing Fee Calculation $_____

**B.** ☐ Design application
($320.00 – 37 C.F.R. § 1.16(f))

Filing Fee Calculation $_____

C. ☐ Plant application

($490.00 - 37 C.F.R. § 1.16(g))

Filing Fee Calculation $_____

**11. Small Entity Statement(s)**

☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. §§ 1.9 and 1.27 is (are) attached.

***WARNING:*** *"Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).*

***WARNING:*** *"Small entity status must not be established when the person or persons signing the. . . statement can **unequivocally** make the required self-certification." M P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).*

(complete the following, if applicable)

☐ Status as a small entity was claimed in prior application

_____/_____, filed on _____, from which benefit is being claimed for this application under:

35 U.S.C. § ☐ 119(e),

☐ 120,

☐ 121,

☐ 365(c),

and which status as a small entity is still proper and desired.

☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of **A**, **B**, or **C** above)

$_____

*NOTE: Any excess of the full fee paid will be refunded if a small entity statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 C.F.R. § 1.28(a).*

**12. Request for International-Type Search** (37 C.F.R. § 1.104(d))

(complete, if applicable)

☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

**13. Fee Payment Being Made at This Time**

☒ Not Enclosed

☐ No filing fee is to be paid at this time.
*(This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)*

☐ Enclosed

☐ Filing fee $_____

☐ Recording assignment
($40.00 – 37 C.F.R. § 1.21(h))
(See attached "COVER SHEET FOR ASSIGNMENT ACCOMPANYING NEW APPLICATION.") $_____

☐ Petition fee for filing by other than all the inventors or person on behalf of the inventor where inventor refused to sign or cannot be reached.
($130.00 – 37 C.F.R. §§ 1.47 and 1.17(i)) $_____

☐ For processing an application with a specification in a non-English language
($130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k)) $_____

☐ Processing and retention fee
($130.00, 37 C.F.R. §§ 1.52(d) and 1.21(l)) $_____

☐ Fee for international-type search report
($40.00; 37 C.F.R. § 1.21(e)) $_____

*NOTE: 37 C.F.R. § 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from the notification under § 53(f).*

**Total fees enclosed** **$**_____

**14. Method of Payment of Fees**

☐ Check in the amount of $_____

☐ Charge Account No. _____ in the amount of $_____
A duplicate of this transmittal is attached.

*NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 C.F.R. § 1.22(b).*

## 15. Authorization to Charge Additional Fees

***WARNING:*** *If no fees are to be paid on filing, the following items should not be completed.*

***WARNING:*** *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.*

☐ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No._____.

- ☐ 37 C.F.R. § 1.16(a), (f), or (g) (filing fees)
- ☐ 37 C.F.R. § 1.16(b), (c), and (d) (presentation of extra claims)

*NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims canceled by amendment prior to the expiration of the time period set for response by the P.T.O. in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the P.T.O. to charge additional claim fees, except possibly when dealing with amendments after final action.*

- ☐ 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)
- ☐ 37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a))
- ☐ 37 C.F.R. § 1.17 (application processing fees)

***WARNING:*** *"...A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).*

- ☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

*NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the Notice of Allowance. 37 C.F.R. § 1.311(b).*

*NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . issue fee." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.*

**16. Instructions as to Overpayment**

*NOTE: "...Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).*

☐ Credit Account No._____
☐ Refund



Date: Nov. 6, 2000

Reg. No. 40,061

Tel. No. (203) 261-1234

Customer No. 004955

Ken Lao
**SIGNATURE OF PRACTITIONER**

Kenneth Q. Lao
(type or print name of practitioner
Ware, Fressola, Van Der Sluys &
Adolphson LLP
755 Main Street
P.O. (Correspondence) Address
P.O. Box 224
Monroe, CT 06468

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.)

☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added _____

☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added _____

☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added _____

☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added _____

☒ **Statement Where No Further Pages Added**

*(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item.*

☒ This transmittal ends with this page.

PATENT
Attorney Docket No. 944-003.030

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION

of

Juha MARILA,
Sami RONKAINEN,
Mika RÖYKKEE
and
Fumiko ICHIKAWA

for a

# METHOD AND APPARATUS FOR MUSICAL MODIFICATION OF SPEECH SIGNAL

Express Mail Label #EL628639024US

# METHOD AND APPARATUS FOR MUSICAL MODIFICATION OF SPEECH SIGNAL

## Field of the Invention

The present invention relates generally to modulating an audio stream with another audio stream and, more particularly, to a vocoding method where a speech signal is used to modulate a string of periodic tones.

## Background of the Invention

The modulation of an audio stream indicative of speech data with another audio stream indicative of a periodic tone has been used to create synthetic music and certain sound effects. This modulation technique is usually referred to as vocoding, and the apparatus for vocoding speech is referred to as a vocoder or a phase vocoder. The term vocoding is derived from VOice CODING. Originally, the motivation for the development of the phase vocoder was to reduce the amount of data required for the transmission of speech over telephone lines or other speech signal transmission medium. For that purpose, vocoders extract pitch and voice information in order to time-compress the speech, and a phase vocoder may be considered as a series of bandpass filters, each having a center frequency. Through the bandpass filtering process, the speech signal is reduced to a series of signal segments carrying the center frequencies.

In an old-styled telephone set, the ringing tone that is used to signal an incoming telephone call is usually produced by a ringer repeatedly striking one or two bells. In a mobile phone, the ringing tone is produced by an electronic buzzer, which produces a pitch of a given frequency according to a value in a data stream representative of a series of musical tones. Likewise, in an electronic organizer or a personal digital assistant, such as a Palm Pilot, a beeping sound is used to remind the user of a scheduled event or the completion of a task requested by the user.

U.S. Patent No. 5,452,354 (Kyronlahti et al.) discloses a ringing tone apparatus wherein subscriber identification information is used to generate the ringing tone. As disclosed in Kyronlahti el al., a ringing tone can be generated based on two or more binary

digits of the subscriber identification number such as the mobile station identification number (MSIN), mobile identification number (MIN), etc. For example, if the lowest bits of the identification MSIN are described as a string of 11 binary digits, D10-D9-D8-D7-D6-D5-D4-D3-D2-D1-D0, these string of digits can be used to specify the parameters necessary for generating a ringing tone as follows: D1 and D0 are used to determine the duration of each ringing tone pulse; D3 and D2 are used to determine the frequency of the ringing tone pulses; D5 and D4 are used to determine the pulse number in one pulse sequence; D7 and D6 are used to determine the number of sequences to be repeated in the ringing tone; and D10, D9 and D8 are used to determine the silence period between pulse sequences. While this tone generation method is useful for producing different ringing tones for different subscribers, the ringing tones have no relevance to speech data, synthetic or natural. Japanese patent No. JP05346787 (Nakae Tetsukazu) discloses a method of extracting pitch data from a digital speech signal and generating a digital musical sound according to the pitch data. The digital speech signal and the digital musical sound are conveyed to a vocoder in order to generate a musical sound signal and a voice signal from which an envelope signal is produced. Finally, the sound signal is modulated with the envelope signal in order to add the nuance of a human voice to a musical sound. For most languages, the so-called musical sound, according to the pitch variation, is confined to one or two notes. For example, in a phrase like "I am Bond, James Bond", there is not much in pitch variation and the resulting musical sound signal may sound like EEE_EE. U.S. Patent No. 5,826,064 (Loring et al.) discloses a user-configurable *earcon* event engine, wherein auditory cues are provided responsive to command messages issued by tasks executed on a computer system. As disclosed, the command messages include an index to an *earcon* data file, which, in turn, includes a reference to an audio file and audio parameter data for manipulating the acoustic parameters of an audio wave. However, the audio wave does not have the content of speech.

It is advantageous and desirable to provide a method and apparatus for modifying a carrier stream indicative of musical tones with a speech signal, wherein a broad range of musical tones can be exploited, regardless of the pitch variation in the speech signal.

Summary of the Invention

The first aspect of the present invention is a method for modification of a speech signal indicative of a stream of speech data having a plurality of syllables. The method comprises the steps of:

mapping the stream of speech data from the speech signal into a stream of tone data according to a predetermined rule regarding the syllables for providing a tone signal indicative of the stream of tone data;

forming a string of musical notes responsive to the tone signal for providing a carrier signal indicative of the string of musical notes;

modulating the carrier signal with the speech signal for providing a modulated signal; and

providing an audible signal representative of the speech signal, musically modified according to the predetermined rule.

Preferably, the predetermined rule includes a linguistic rule for assigning one, two or more notes to a syllable of the speech data based on a vowel of the syllable, a consonant of the syllable, or the intonation of the syllable.

It is also possible to assign one, two or more tones to a syllable of the speech data based on a combination of a vowel, a consonant and/or the intonation of the syllable.

It is possible to assign a tone color (timbre), tempo, and/or a pitch range to the musical notes.

Preferably, the speech signal is provided in response to an incoming telephone call on a telephone, and the audible signal is indicative of the incoming telephone call.

Preferably, the speech signal is provided in response to a message on a telephone or a communicator, and the audible signal is indicative of the message.

Preferably, the speech signal is provided in response to a scheduled event in a personal digital assistance device, and the audible signal is indicative of the schedule.

Preferably, the speech signal is provided to indicate a user-interface event regarding an electronic device, wherein the user-interface event can be represented by an object positioned in the electronic device based on a hierarchy, and the predetermined rule is based on the position of the object in the hierarchy.

The second aspect of the present invention is an apparatus for modification of a speech signal indicative of a stream of speech data having a plurality of syllables. The apparatus comprises:

a mapping mechanism, responsive to the speech signal, for mapping the syllables into a stream of tone data based on a predetermined rule regarding the syllables, and for providing a tone signal indicative of the stream of tone data;

a forming mechanism, responsive to the tone signal, for providing a string of musical notes based on the stream of tone data, and for providing a carrier signal indicative of the string of musical notes;

a modulation mechanism, responsive to the carrier signal, for modulating the carrier signal with the speech signal, and for providing a modified speech signal indicative of the modulation; and

a sound production device, responsive to the modified speech signal, for providing an audible signal representative of the speech signal, musically modified according to the predetermined rule.

Preferably the modified speech signal is further combined with the unmodified speech signal in order to adjust the musical content in the audible signal.

Preferably, the modulation mechanism is a phase vocoder, and the modulation is according to the process of vocoding.

The present invention will become apparent upon reading the description taken in conjunction with Figures 1 to 5.

Brief Description of the Drawings

Figure 1 is a flow chart illustrating the method for modification of a speech signal, according to the present invention.

Figure 2 is a block diagram illustrating the apparatus for modification of a speech signal, according to the preferred embodiment of the present invention.

Figure 3 is a block diagram illustrating another embodiment of the speech signal modification apparatus.

Figure 4 is a diagrammatic representation illustrating a telephone or communicator in

which a modified speech signal is used to indicate an incoming phone call.

Figure 5 is a diagrammatic representation illustrating an electronic organizer or a personal digital assistant device in which a modified speech signal is used to alert the user of an upcoming event.

Detailed Description of the Invention

Instead of producing a ringing tone in a telephone that has no relevancy to the user of the called party, it is advantageous to provide a musically modified speech signal to signal an incoming telephone call or to reminder the user of a message left by a called party. For example, it is possible to provide a musically modified speech signal derived from the user's name, or the name of the called party of an incoming phone call. In certain languages, such as Italian, Spanish and Japanese, personal names such as Giacomo Puccini, Pablo Picasso, Akira Kurosawa can be represented by a string of syllables as GIA-CO-MO_PUC-CI-NI, PA-BLO_PI-CAS-SO, A-KI-RA_KU-RO-SA-WA. These strings of syllables can be made into a string of musically modified speech data according to a simple rule based on the vowel, the consonant or a combination of a vowel and a consonant in each syllable. In particular, Japanese words and syllables are made up of kana symbols. The kana symbols make it easy to assign a syllable to a musical note in order to generate a string of musical notes indicative of the syllables. For example, the vowels a, i, u, e, o can be mapped onto five musical notes, namely, C, D, E, G, A, as shown in TABLE I.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C= | a | ka | sa | ta | na | ha | ma | ya | ra | wa | n |
| D= | i | ki | shi | chi | ni | hi | mi | | ri | | |
| E= | u | ku | su | tsu | nu | fu | mu | yu | ru | | |
| G= | e | ke | se | te | ne | he | me | | re | | |
| A= | o | ko | so | to | no | ho | mo | yo | ro | o | |

TABLE I - VOWEL AS TONE DETERMINANT

Thus, when a syllable includes a vowel 'u', as in 'ku', 'tsu', etc, is assigned the musical note

E. Following this linguistic rule, we have

Fumiko Ichikawa (FU-MI-KO_I-CHI-KA-WA) = EDA_DDCC
Akira Kurosawa (A-KI-RA_KU-RO-SA-WA) = CDC_EACC
Yukio Mishima (YU-KI-O_MI-SHI-MA) = EDA_DDC.

The symbol '_' signifies a pause the length of which can be made equal to or different from the musical notes. With a similar rule, a string of syllables such as "I-AM-BOND_JAMES-BOND" may be mapped into a string of musical notes as DCA_CA.

Similarly, a linguistic rule can be set up based on the consonant of the syllables. For example, the musical note C can be assigned to 'ka', 'ki', 'ku', 'ke', ko', and A can be assigned to 'na', 'ne', 'nu', 'ne', 'no', as shown in TABLE II.

| C | D | E | G | A | C2 | D2 | E2 | G2 | A2 |
|---|---|---|---|---|---|---|---|---|---|
| a | ka | sa | ta | na | ha | ma | ya | ra | wa |
| i | ki | shi | chi | ni | hi | mi | | ri | n |
| u | ku | su | tsu | nu | fu | mu | yu | ru | |
| e | ke | se | te | ne | he | me | | re | |
| o | ko | so | to | no | ho | mo | yo | ro | o |

TABLE II - CONSONANT AS TONE DETERMINANT

It should be noted that 'n' has been moved to the second row, and C2 denotes an octave higher than C. To use consonants as tone determinant, the tone range of two octaves is sufficient. Following the linguistic rule as set forth in TABLE II, we have:

Fumiko Ichikawa (FU-MI-KO_I-CHI-KA-WA) = C2D2D_CGDA2
Akira Kurosawa (A-KI-RA_KU-RO-SA-WA) = CDG2_DG2EA2
Yukio Mishima (YU-KI-O_MI-SHI-MA) = E2DA2_D2ED2

In many Western languages, however, there may be too many different consonants and multi-consonants, such as pr, pl, tr, chr and spl, in the syllables to be mapped into musical notes within two or three octaves. It is possible to use a linguistic rule similar to the rule as set forth in TABLE III. The linguistic rules, as set forth in TABLE I and TABLE II, are based on a monophonic implementation of the pentatonic scale. TABLE III illustrates a rule that is based on a polyphonic implementation of the major Western scale for consonants and pentatonic for vowels.

| | D | E | F | G | A | B | C | C2 | D2 | A2 |
|---|---|---|---|---|---|---|---|---|---|---|
| C | a | ka | sa | ta | na | ha | ma | ya | ra | wa |
| D | i | ki | shi | chi | ni | hi | mi | | ri | n |
| E | u | ku | su | tsu | nu | fu | mu | yu | ru | |
| G | e | ke | se | te | ne | he | me | | re | |
| A | o | ko | so | to | no | ho | mo | yo | ro | o |

TABLE III - POLYPHONIC IMPLEMENTATION USING VOWELS AND CONSONANTS

Following the linguistic rule as set forth in TABLE III, we have

Fumiko Ichikawa (FU-MI-KO_I-CHI-KA-WA) = C2D2D_CGDA2
E D A_ DDCC

Akira Kurosawa (A-KI-RA_KU-RO-SA-WA) = CDG2_DG2EA2
CDC _EA C C

Yukio Mishima (YU-KI-O_MI-SHI-MA) = E2DA2_D2ED2
E D A _ D D C

Furthermore, the voiced/unvoiced (*nigori/maru*) and compound kana characters can be mapped to the closest equivalent syllables in the system, or they can be designated their own musical notes. Moreover, when a string of musical notes derived from a name according to one rule (e.g., the vowel rule) sounds too monotonic, it is possible to substitute it with a

string of musical notes using another rule (e.g, the consonant rule). The *nigori* symbols (ga, gi, gu, ge, go), (za, ji, zu, ze, zo), (da, ji, du, de, do) and (ba, bi, bu, be, bo), are derived from, respectively, the upper-case characters (ka, ki, ku, ke, ko), (sa, shi, su, se, so), (ta, chi, tzu, te, to) and (ha, hi, fu, he, ho). When they are combined with other words to become compounds, the characters from which they are derived become voiced. For example, *hana* (nose), plus *chi* (blood), combine to form *hanaji*, and the character, *chi*, becomes voiced. When treated as syllables in compounds, the nigori symbols can be mapped to the same musical notes as the characters from which they derived, if so desired. Similarly, the *maru* symbols (pa, pi, pu, pe, po) can be mapped to the same musical notes as the upper-case characters of (ta, chi, tzu, te, to) from which they are derived. As for the lower-case compound characters, kya, kyu, kyo, gya, gyu, gyo, cha, etc., they can be mapped to the closest equivalent syllables in the system, but they can have a different tempo or time-stretch. For example, ki and kya can be mapped to the same musical note with different durations or different tone colors. Another symbol, the lower-case *tsu,* doubles the next consonant when it is placed before that consonant. For example, by placing *tsu* before *ka, ka* is stretched out as *kka*. Accordingly, kka can be mapped to the same musical note as ka with a longer duration.

In languages such as Chinese and Vietnamese, a plurality of intonations are used to modify the pronunciation of single-syllable words. In Mandarin Chinese, four intonations are used to modify the pronunciation, and the intonations are denoted herein with subscripts 1, 2, 3 and 4. For example, the different intonations applied to 'ba' are:

$ba_1$ (eight), $ba_2$ (to pull out), $ba_3$ (target), $ba_4$ (dam)

It is thus possible to assign four different musical tones such as C, D, G, A to the intonations 1, 2, 3, 4 as further shown in TABLE IV:

| | | | |
|---|---|---|---|
| C | $ba_1$ (eight) | $tan_1$ (greedy) | $xing_1$ (star) |
| D | $ba_2$ (to pull out) | $tan_2$ (to chat) | $xing_2$ (model) |
| G | $ba_3$ (target) | $tan_3$ (flat) | $xing_3$ (to wake up) |
| A | $ba_4$ (dam) | $tan_4$ (charcoal) | $xing_4$ (apricot) |

TABLE IV - INTONATION AS TONE DETERMINANT

Following this linguistic rule, the musical notes assigned to the Chinese pronunciation of the late Japanese writer Yukio Mishima would be:

$$san_1\ dao_3\ \_you_2\ ji_4\ fu_1 = CG\_DAC$$

With rules as illustrated above, it is possible to assign a music note to a syllable in a speech signal in a variety of languages in accordance with the vowel, the consonant, or the intonation of the syllable.

It should be noted that, in a communication device such as a telephone, when using synthetic speech to make an announcement, the speech signal can simply be a stream of speech data having a plurality of syllables. From these syllables, it is possible to form a stream of musical notes based on a selected linguistic rule. The stream of musical notes can then be used as a carrier stream to musically modify, the stream of speech data. The musically modified speech data can be conveyed to a sound-producing device to make an audible signal. As such, the speech content is transformed into a musical form. Depending on the nature of the speech data, the musically modified speech data may or may not bear resemblance to the speech signal. Thus, it is possible to mix the musically modified speech data with the unmodified speech data. The mixing proportion can be adjusted so that the resulting sound will sound like speech having a certain mix of musical characteristics.

The linguistic rules, as described above, can also be used in an electronic device to provide auditory cues indicating a user-interface (UI) event. Typically, the UI events on an electronic device, such as a computer, are represented by objects or icons. According to the present invention, the UI objects or icons are further represented by auditory icons so that the user of the electronic device can be notified of the UI events using the auditory cues. For example, an auditory icon for arriving e-mail could be represented by musically modified syllables of "mes-sa-ges". The musical notes can be assigned to these syllables according to the vowel, the consonant or the syllabic intonation. Similarly, the UI event of "reply to a

message" could be represented by musically modified syllables of "re-ply-to-mes-sage". It should be noted that the objects in device UI can be categorized in a hierarchical manner. For example, the hierarchy of a UI event indicates whether the event is related to a folder, a file, or the file's place in the file list. The division and the placement of objects in device UI can be further indicated by timbre, tempo and a pitch range. Timbre is a tone color of a sound, imitating the sound of a piano, an English horn, a flute and so forth. Tempo is a measure of time, or the duration, of each musically modified syllable. TABLE V lists a few examples of the auditory cues representing UI events, wherein the musical notes are assigned to the syllable according to syllabic intonation.

| Hierarchy level | UI function | Timbre | Pitch range | Tempo | Melody | Speech |
|---|---|---|---|---|---|---|
| 1 | Messages | English horn | 2 | 100 | G2-E2-C2 | Messages |
| 1 | Calendar | Electric piano | 2 | 100 | A2-D2-F#2 | Calendar |
| 2 | Inbox (Messages) | English horn | 3 | 100 | E3-C3-G2-C3-C3 | Messages inbox |
| 2 | View day notes (Calendar) | Electric piano | 3 | 100 | F#3-D3-A2 | View day notes |
| 3 | Reply (to a message) | English horn | 3 | 140 | F3-E3-C3-G2-C3 | Reply to message |
| 3 | Delete a calendar note | Electric piano | 3 | 140 | B3-A3-F#3-D3 | Delete the note |

TABLE V
TEMPO AND PITCH RANGE ASSIGNMENT
BASED ON HIERARCHY LEVEL

Accordingly, the vocoded end result is as follows:

Messages (MES-SA-GES) = G2E2C2

Calendar (CAL-END-AR) = A2D2F#2

Inbox {Messages} (MES-SA-GES_IN-BOX) = E3C3G2_C3C3
View day notes {Calendar} (VIEW_DAY_NOTES) = F#3_D3_A2
Delete the note (DEL-ETE_THE_NOTE) = B3A3_F#3_D3

In the examples shown above, the musical form for each UI event is designed such that there are as many musical notes as the spoken content has syllables. It should be noted that, while the mapping of musical notes to a string of syllables is predetermined by a linguistic rule, the assignment of the pitch range, timbre, and tempo to the objects of device UI is more or less arbitrary. It is more of a question of design.

The method **1** for musically modifying a speech signal, according to the present invention, is summarized in Figure 1. As shown, the speech signal is organized into a string of syllables at step **2**. Using a selected linguistic rule, the string of syllables is mapped into a string of tone data at step **4**. The string of tone data is transformed into a carrier stream of musical notes at step **6**. Optionally, the carrier stream of musical notes is modified to include timbre representing the sound of a musical instrument, at step 8. The carrier stream is modulated with the speech signal to produce a musically modified speech signal at step **10**. Optionally, the musically modified speech signal is combined with the unmodified speech signal at step **12** so as to adjust the amount of musical content in the speech signal. It is understood that the resulting signal can be a completely musically modified speech signal or completely unmodified speech or anything in between. The resulting signal is conveyed to a sound-producing device to produce an audible signal at step **14**.

Figure 2 illustrates the apparatus **20** for musically modifying a speech signal **110**, according to the preferred embodiment of the present invention. As shown in Figure 2, when a string of speech data **100** is provided by a phone engine or a data processor (see Figures 3 and 4) to a speech synthesizer **22**, the speech synthesizer **22** produces a speech signal **110** indicative of the speech data **100**. Typically, the speech data **100** contains a string of syllables. A mapping device **30** is used to map the speech data **100** into a string of tone data **112** based on a linguistic rule **32**. A tone synthesizer **40** is used to transform the string of tone data **112** into a carrier signal **114**. It is possible that the tone synthesizer **40** includes a mechanism for including a tone color to the carrier signal **114** so that the carrier signal **114**

has the timbre of a selected instrument. If the carrier signal **114** is fed to a sound producing device **60** to produce an audible signal, then the audible signal would be a string of musical notes played by the selected instrument. However, according to the present invention, the carrier signal **114** is modulated with the speech signal **110** in a modulator **50** in order to produce a musically modified speech signal **120**. Based on the musically modified speech signal **120**, the sound-producing device **60** produces an audible signal **122,** which has both speech-like characteristics and musical characteristics. In that respect, the modification of the speech signal by the carrier signal containing a string of musical notes is somewhat related to the vocoding process, and the audible signal **122** can be referred to as a vocoded signal. Accordingly, the modulator **50** can be a phase vocoder.

How much the audible signal **122** sounds like speech depends on a variety of factors. It may depend on the language itself, or on the linguistic rule (TABLE I to TABLE V, or the like). Thus, it is also preferred that the amount of musical modification be adjusted so that the audible signal **122** can be more speech-like than music-like. Figure 3 illustrates another embodiment of the apparatus **20'** for musically modifying the speech signal **100**, according to the present invention. As shown, the musically modified speech signal **120** is conveyed to a switch **56** before being fed into the sound-producing device **60**. The musically modified speech signal **120** can be combined with the unmodified speech signal **110** in a mixer **52** in order to produce a mixed signal **116**. The mixer **52** allows a user to adjust the amount of musical content in the mixed speech signal **116,** which is conveyed to the switch **56**. Furthermore, the unmodified speech signal **110** is also conveyed to the switch **56,** so that a user can select which of the signals **110**, **116** or **120** is to be used to generate the audible signal **122'**. With the switch **56**, the user can choose the audible signal **122'** to be generated from the fully modified speech signal **120**, the partially modified speech signal **116** or the unmodified speech signal **110**. The selected speech signal is denoted by reference numerical **120'**.

The audible signal **122** can be used in many different ways. Figures 4 and 5 illustrate two examples. Figure 4 shows a mobile phone **202** having an information display area **212**. For example, the display area **212** can be used to display the name and phone number **222** of the calling party of an incoming call. In receiving the incoming call, a phone engine **232**

produces a string of speech data **100** based on which apparatus **20** (or **20'**) produces the signal **120** (or **120'**). The audible signal **122** (or **122'**) produced by the speaker **60** can be used, for example, as a ringing tone to signal the incoming call. The audible signal **122** can also be used to notify the telephone user of a message left by a calling party, or to alert the user when a search in the phone book contents is accomplished.

Figure 5 shows an electronic organizer or a personal digital assistant (PDA) **204,** which also has an information display area **214**. It is well known that a personal digital assistant can be used as an address book, an appointment book and as information storage for various organizational functions. When the PDA **204** is used to keep track of one or more scheduled events, the PDA **204** can produce an audible signal **122** to alert the user of an upcoming scheduled event when the scheduled event is due or near, or indicate that a scheduled event or note has been deleted from a calendar. As shown, a scheduled event **224** is supplied to the display **214** by a data processor **234**. At the same time, the data processor **234** produces a string of speech data **100** based on which the apparatus **20** (or **20'**) produces the signal **120** (or **120'**). When the PDA **204** is also used for transmitting and receiving e-mail messages, the audible signal **122** can be used to notify the user of the reception of a message by the PDA **204**. The audible signal **122** can also be used to indicate the message is replied or deleted.

The vocoded signal, or the audible signal **122,** as shown in Figures 4 and 5, can be used for many different purposes. The audible signal **122** can indicate the caller's name, the telephone user or the event. The audible signal **122** that is used to indicate a message can be different from the audible signal **122** that is used to indicate an incoming call. The audible signal **122** can be different from one time to another. There are many linguistic rules different from those illustrated above. For example, one can combine the vowel, the consonant and the intonation rules within one rule. One can assign two notes to one syllable (e.g, FU-MI-KO_I-CHI-KA-WA = CE-BD-FA_BD-BD-AC-AC). One can also vary the duration of the musical notes in many different ways.

Thus, although the invention has been described with respect to the preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and various other changes, omissions and deviations in the form and detail thereof may be made

without departing from the spirit and scope of this invention.

What is claimed is:

1. A method for modification of a speech signal indicative of a stream of speech data having a plurality of syllables, comprising the steps of:

mapping the stream of speech data from the speech signal into a stream of tone data according to a predetermined rule regarding the syllables for providing a tone signal indicative of the stream of tone data;

forming a string of musical notes responsive to the tone signal for providing a carrier signal indicative of the string of musical notes;

modulating the carrier signal with the speech signal for providing a modified signal; and

providing an audible signal representative of the speech signal, according to the modified signal, musically modified according to the predetermined rule.

2. The method of claim 1, wherein the predetermined rule includes an assignment of at least a tone to a syllable of the speech data, based on a vowel of the syllable.

3. The method of claim 1, wherein the predetermined rule includes an assignment of at least a tone to a syllable of the speech data, based on a consonant of the syllable.

4. The method of claim 1, wherein the predetermined rule includes an assignment of at least a tone to a syllable of the speech data, based on an intonation of the syllable.

5. The method of claim 1, wherein the predetermined rule includes an assignment of at least a tone to a syllable of the speech data, based on a combination of a vowel and a consonant of the syllable.

6. The method of claim 1, wherein the predetermined rule includes an assignment of tempo to the musical notes.

7. The method of claim 1, wherein the predetermined rule includes an assignment of a tone color to the carrier signal indicative of a musical instrument.

8. The method of claim 1, wherein the predetermined rule includes a linguistic rule based on language of the speech data.

9. The method of claim 1, wherein the speech signal is provided in response to an incoming telephone call on a telephone, and the audible signal is indicative of the incoming telephone call.

10. The method of claim 1, wherein the speech signal is provided in response to a message on a telephone or a communicator, and the audible signal is indicative of the message.

11. The method of claim 1, wherein the speech signal is provided in response to a scheduled event in a personal digital assistance device, and the audible signal is indicative of the scheduled event.

12. The method of claim 1, wherein the speech signal is provided in response to a search in phone book contents by a user, and the audible signal is indicative of the search being accomplished.

13. The method of claim 1, wherein the speech signal is provided in response to a user-interface event in an electronic device, and the audible signal is indicative of the user-interface event.

14. The method of claim 1, wherein the speech signal is provided in response to a user-interface event in an electronic device, wherein the user-interface event is arranged according to a hierarchy of positions in the electronic device, and the predetermined rule musically modifies the speech signal according to the position of the user-interface event in the

hierarchy.

15. The method of claim 14, wherein the predetermined rule includes an assignment of a tone color to the carrier signal based on the position of the user-interface event in the hierarchy.

16. The method of claim 14, wherein the predetermined rule includes an assignment of a pitch range to the carrier signal based on the position of the user-interface event in the hierarchy.

17. An apparatus for modification of a speech signal indicative of a stream of speech data having a plurality of syllables, comprising:

a mapping mechanism, responsive to the speech signal, for mapping the syllables into a stream of tone data based on a predetermined rule regarding the syllables, and for providing a tone signal indicative of the stream of tone data;

a forming mechanism, responsive to the tone signal, for providing a string of musical notes based on the stream of tone data, and for providing a carrier signal indicative of the string of musical notes;

a modulation mechanism, responsive to the carrier signal, for modulating the carrier signal with the speech signal, and for providing a modified speech signal indicative of the modulation; and

a sound production device, responsive to the modified speech signal, for providing an audible signal representative of the speech signal, musically modified according to the predetermined rule.

18. The apparatus of claim 17, wherein the predetermined rule includes a linguistic rule based on language of the speech data.

19. The apparatus of claim 17, wherein the speech data is indicative of a user-interface.

20. An electronic device, comprising:

a generating mechanism, responsive to a user-interface event, for providing a speech signal indicative of the user-interface event, wherein the speech signal includes a stream of speech data having a plurality of syllables;

a mapping mechanism, responsive to the speech signal, for mapping the syllables into a stream of tone data based on a predetermined rule regarding the syllables, and for providing a tone signal indicative of the stream of tone data;

a forming mechanism, responsive to the tone signal, for providing a string of musical notes based on the stream of tone data, and for providing a carrier signal indicative of the string of musical notes;

a modulation mechanism, responsive to the carrier signal, for modulating the carrier signal with the speech signal, and for providing a modified speech signal indicative of the modulation; and

a sound production device, responsive to the modified speech signal, for providing an audible signal representative of the speech signal, musically modified according to the predetermined rule.

21. The electronic device of claim 20, wherein the user-interface event includes an incoming telephone call using the electronic device.

22. The electronic device of claim 20, wherein the user-interface event includes an incoming telephone call using the electronic device, and the audible signal is indicative of the telephone call.

23. The electronic device of claim 20, wherein the user-interface event includes a message received by the electronic device, and the audible signal is indicative of the reception of the message.

24. The electronic device of claim 20, wherein the user-interface event includes a message received by the electronic device, and the audible signal is indicative of deletion of the

message.

25. The electronic device of claim 20, wherein the user-interface event includes a scheduled event in a calendar, and the audible signal is indicative of the scheduled event.

26. The electronic device of claim 20, wherein the user-interface event includes a scheduled event in a calendar, and the audible signal is indicative of entry of the scheduled event in the calendar.

27. The electronic device of claim 20, wherein the user-interface event includes a scheduled event in a calendar, and the audible signal is indicative of deletion of the scheduled event from the calendar.

Abstract of the Disclosure

A method and apparatus for modification of a speech signal indicative of a stream of speech data having a plurality of syllables. The method comprises the steps of mapping the stream of speech data from the speech signal into a stream of tone data according to a linguistic rule regarding the syllables for providing a tone signal indicative of the stream of tone data; forming a string of musical notes responsive to the tone signal for providing a carrier signal indicative of the string of musical notes; modulating the carrier signal with the speech signal for providing a modified signal; and providing an audible signal representative of the speech signal, musically modified according to the linguistic rule. The linguistic rule includes an assignment of a tone to a syllable of the speech data based on a vowel of the syllable, a consonant of the syllable, the intonation of the syllable for a monosyllabic language. The musically modified speech signal can be used to indicate an incoming telephone call, a message left on a telephone, a scheduled event, or the like.

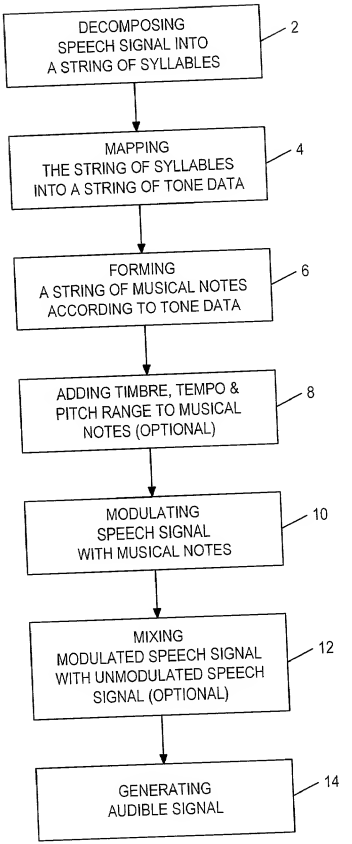
DECOMPOSING
SPEECH SIGNAL INTO
A STRING OF SYLLABLES
2
MAPPING
THE STRING OF SYLLABLES
INTO A STRING OF TONE DATA
4
1
FORMING
A STRING OF MUSICAL NOTES
ACCORDING TO TONE DATA
6
ADDING TIMBRE, TEMPO &
PITCH RANGE TO MUSICAL
NOTES (OPTIONAL)
8
MODULATING
SPEECH SIGNAL
WITH MUSICAL NOTES
10
MIXING
MODULATED SPEECH SIGNAL
WITH UNMODULATED SPEECH
SIGNAL (OPTIONAL)
12
GENERATING
AUDIBLE SIGNAL
14

FIG. 1

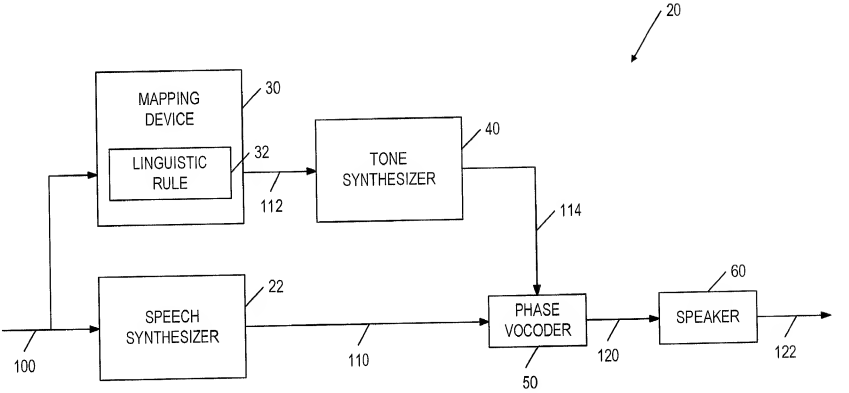


FIG. 2

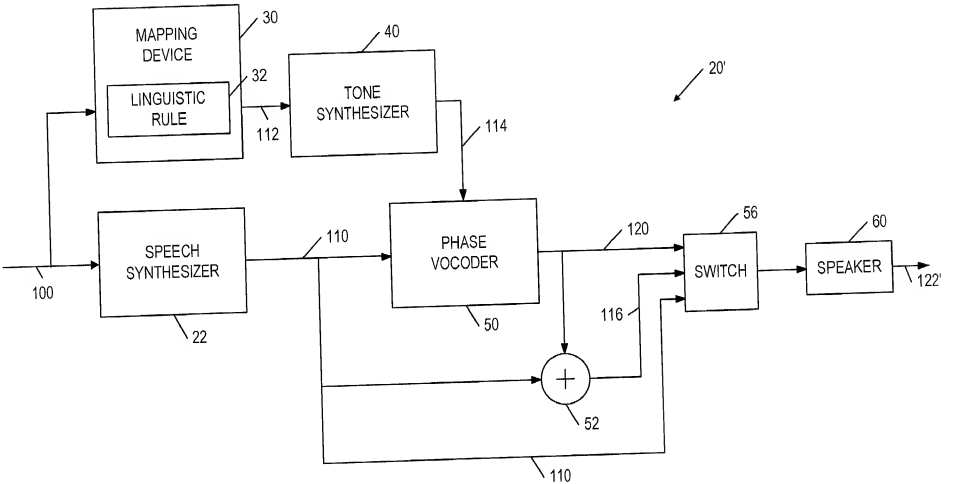


FIG. 3

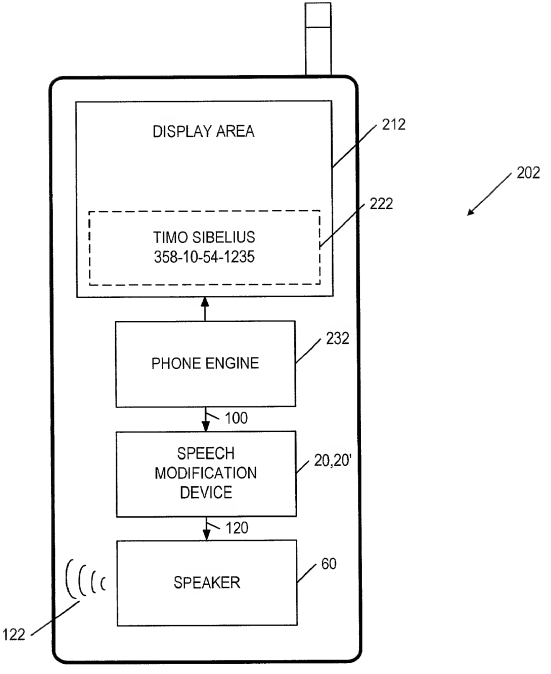
DISPLAY AREA
212
202
222
TIMO SIBELIUS
358-10-54-1235
PHONE ENGINE
232
100
SPEECH
MODIFICATION
DEVICE
20,20'
120
SPEAKER
60
122

FIG. 4

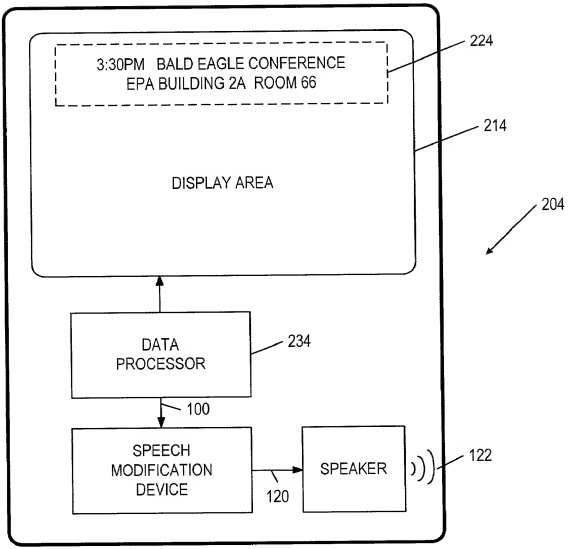
3:30PM BALD EAGLE CONFERENCE
EPA BUILDING 2A ROOM 66
224
214
DISPLAY AREA
204
DATA
PROCESSOR
234
100
SPEECH
MODIFICATION
DEVICE
120
SPEAKER
122

FIG. 5